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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte NATHAN R. BROWN

Appeal 2008-3352
Application 10/715,267
Technology Center 1700

Decided: July 31, 2008

Before PETER F. KRATZ, CATHERINE Q. TIMM, and
MICHAEL P. COLAIANNI, *Administrative Patent Judges*.

COLAIANNI, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant appeals under 35 U.S.C. § 134 the final rejection of claims 1, and 3-31. We have jurisdiction over the appeal pursuant to 35 U.S.C. § 6(b).

We AFFIRM.

INTRODUCTION

Appellant claims a method of polishing or planarizing a surface of a semiconductor device structure comprising, in relevant part, "biasing independently movable pressurization structures to selectively apply a

plurality of different amounts of pressure to different, selected locations of a backside of the semiconductor device structure" (claim 1). By controlling the amount of force applied based on the difference in height between the raised and lower areas on the active surface of the semiconductor device, a substantially constant material removal rate across the entire surface is achieved to form a substantially planar surface on the semiconductor device structure during polishing (Spec. ¶ [0010]).

Claims 1, 3, and 16 are illustrative:

1. A method for polishing or planarizing a surface of a semiconductor device structure, comprising:

biasing independently movable pressurization structures to selectively apply a plurality of different amounts of pressure to different, selected locations of a backside of the semiconductor devices structure; and

polishing or planarizing at least one layer on the surface of the semiconductor device structure.

3. The method of claim 1, wherein biasing comprises magnetically biasing at least one of the independently movable pressurization structures against the backside.

16. A method for polishing at least one layer on a semiconductor device structure, comprising:

polishing at least one layer of a first semiconductor device structure;

locating any raised areas on the first semiconductor device structure following the polishing;

selectively applying pressure to a backside of at least one second semiconductor device structure of a same type as the first semiconductor device structure, the selectively applying being effected at locations beneath areas of the at least one second semiconductor device structure that correspond to the raised areas of the first semiconductor device structure; and

at least mechanically polishing at least one layer of the at least one second semiconductor device structure.

The Examiner relies on the following prior art references as evidence of unpatentability:

Chen	6,436,828 B1	Aug. 20, 2002
Sommer	6,561,871 B1	May 13, 2003
Williams	6,594,542 B1	Jul. 15, 2003
Kajiwara	6,623,343 B2	Sep. 23, 2003 (May 12, 2000)

The rejections as presented by the Examiner are as follows:

1. Claims 1 and 6-15 are rejected under 35 U.S.C. § 102(e) as being unpatentable over Kajiwara.
2. Claims 3-5 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Kajiwara in view of Chen.
3. Claims 16-31 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Sommer or Chen in view of Williams.

With regard to each of the rejections, Appellant argues the respective claims under the particular rejection as a group. Pursuant to 37 C.F.R. § 41.37(c)(1)(vii), we decide this appeal based upon our selection of the following claims from each respective claim grouping: (1) with regard to the § 102(e) rejection above, we address Appellant's arguments with regard to claim 1, (2) with regard to the second rejection above, we address Appellant's arguments with regard to claim 3, and with regard to the third rejection above, we address Appellant's arguments with regard to claims 16. With regard to claims 17-20 and 25, Appellant's arguments simply point out what these claims recite and indicate that Chen, Sommer, and Williams do not teach or suggest the particular claim limitations. Appellant has not substantively argued or provided evidence that the features of claims 17-20

and 25 are not taught or suggested by the combined teachings of the applied prior art. Pursuant to 37 CFR 41.37(c)(1)(vii), a statement that merely points out what a claim recites will not be considered an argument for separate patentability of the claim. Accordingly, claims 17-20 and 25 stand or fall with claim 16.

OPINION

35 U.S.C. § 102(e) REJECTION OVER KAJIWARA

Appellant argues that Kajiwara's bladders 255 are independently inflatable and pressurizable, not independently movable as required by claim 1 (Br. 6). Appellant argues that Kajiwara inflates the bladders 255 to apply pressure to membrane 250 such that the bladders 255 do not individually apply pressure to a surface of a semiconductor device (Br. 6). Appellant contends that Kajiwara's membrane 250 would spread out the pressure applied thereto by any one bladder 255 to even out the pressure applied to the substrate (Br. 6).

We have considered Appellant's arguments and are unpersuaded for the reasons below.

A claim is anticipated only if each and every element as set forth in the claim is found either expressly or inherently described in a single prior art reference. *Verdegaal Bros., Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987).

In the present appeal the central issue is whether Kajiwara's independently inflatable and pressurizable bladders 255 of the Figure 9 embodiment or membranes 336A-336D of the Figure 24 embodiment constitutes "independently movable pressurization structures" as claimed.

We agree with the Examiner that the bladders 255 of the Figure 9 embodiment constitute independently movable pressurization structures. Similarly, we determine that membranes 336A-336D in the Figure 24 embodiment further constitute independently movable pressurization structures.

We begin our analysis by construing "independently movable pressurization structures." During examination, claim terms are given their broadest reasonable interpretation consistent with the Specification. *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004).

Appellant's Specification describes the claimed "independently moveable pressurization structures" as preferably annular rings 12 whose movement against the semiconductor device structure 20 are controlled via actuators 14 (Spec. ¶ [0034], Figures 1 and 2). Appellant discloses that the actuators 14 may be magnetic controllers or expandable pistons that move the annular rings according to the expansion of the pistons' chamber caused by the application of pressure via a fluid to the chamber (Spec. ¶ [0051], Figure 8). In other words, Appellant's "independently movable pressurization structures" include outer portions of enclosed chambers (i.e., the pressurization structures 112" attached to the piston 117) forced outwardly by a pressurized fluid.

In light of these disclosures, we construe "independently movable pressurization structures" as including outer portions of enclosed chambers that independently move outwardly by pressurization of the chambers.

Therefore, contrary to Appellant's argument, we agree with the Examiner's determination that Kajiwara's bladders 255 of the Figure 9 embodiment for example, constitute independent pressurization structures.

We also determine that Kajiwara's membranes 336A to 336D of the Figure 24 embodiment constitute "independently movable pressurization structures." Specifically, the outer portions of the bladders 255 or membranes 336A to 336D constitute the pressurization structure which is forced outwardly and against the wafer when the bladders 255 or membranes 336A to 336D are pressurized. The pressurization of the bladders 255 or membranes 336A to 336D causes the membranes or bladders to expand or inflate, thereby pressing (i.e., biasing) the outer portion of the membranes or bladders against the wafer. Kajiwara further discloses that the bladders 255 permit a region to be polished or planarized at a higher or lower pressure than the surrounding areas (i.e., the bladders may independently apply higher or lower force to regions of the substrate needing it) (Kajiwara, col. 18, ll. 52-67) and that membranes 336A to 336D may be independently controlled (i.e., pressurized) (Kajiwara, col. 29, ll. 26-30).

For three reasons we are unpersuaded by Appellant's argument that Kajiwara's membrane, for example, would cause any force applied by the bladders 255 to be dispersed or spread out by the membrane 250. First, Appellant's position is contrary to the express teachings of Kajiwara. Kajiwara expressly discloses that the pressurized gas or fluid in the various bladders are chosen to provide the desired polishing pressure profile across the wafer surface and that the bladders may provide higher or lower pressure to a region of the substrate than to the surrounding regions (Kajiwara, col. 18, ll. 52-56, 62-64). In other words, the force is different at various areas along the wafer surface such that a desired polishing profile is achieved. Second, Appellant provides no objective evidence to support the position that the force applied would be spread out such that the pressure would

"even out" (Br. 6). Third, the claim does not recite that the pressurization structures "individually apply pressure to a surface of the semiconductor device structure" as argued. Instead, the claim recites biasing the "independently movable pressurization structures to selectively apply a plurality of different amounts of pressure to different, selected locations of a backside of the semiconductor device structure" (claim 1). Appellant's argument is narrower than the claim.

For the above reasons, we sustain the Examiner's § 102(e) rejection of claims 1, and 6-15 over Kajiwara.

35 U.S.C. § 103 REJECTION OVER KAJIWARA IN VIEW OF CHEN

Appellant argues that neither Kajiwara nor Chen discloses biasing independently movable pressurization structures against the backside of a semiconductor device (Br.10-11). Appellant further argues that since neither Kajiwara nor Chen teaches or suggests an apparatus that includes elements that individually apply pressure to corresponding regions of a semiconductor substrate, one of ordinary skill in the art would not have been motivated to combine the teachings of these references in the asserted manner, or had any reason to expect that their combination in the asserted manner would have been successful (Br. 11).

Contrary to Appellant's arguments and as noted above in our discussion of the § 102(e) rejection over Kajiwara, we find that Kajiwara discloses biasing independently movable pressurization structures as claimed. Accordingly, Appellant's argument is not persuasive.

Moreover, we note that Chen discloses independently and selectively controlling the force applied by portions of the membrane 104 to the

substrate 10 by using coils 108, 110, and 112 (Chen, col. 4, ll. 45-60; col. 5, ll. 5-13, 30-46; col. 6, ll. 23-31). Chen discloses embedding magnetic particles in the membrane 104 to permit magnetic control of the membrane (Chen, col. 4, ll. 45-50). Chen further discloses that the coils may be controlled to amplify or decrease the force in certain areas of the membrane 104 (Chen, col. 6, ll. 1-22).

Based on Chen's disclosures, we find that Chen, like Kajiwara's Figure 24 embodiment, discloses biasing independently movable pressurization structures (i.e., portions of the membrane 104). Accordingly, Kajiwara and Chen both disclose the argued claim feature.

We are unpersuaded by Appellant's motivation and reasonable expectation of success arguments. Rather, we find that Kajiwara's Figure 24 embodiment discloses that polishing head 300 may have a single membrane with four interior walls dividing the internal chamber of the membrane to form five zones (Kajiwara, col. 29, ll. 24-26). Kajiwara discloses that the five zones may be controlled either simultaneously or substantially independently (Kajiwara, col. 29, ll. 26-28).

Chen discloses carrier head 100 having a pressurized chamber 120 with a single membrane 104 (Chen, col. 4, ll. 65-67; col. 5, ll. 1-4). Chen discloses the membrane 104 having magnetic particles such that the force applied by the membrane to the substrate 10 may be selectively and independently controlled using coils 108, 110, and 112 (Chen, col. 4, ll. 45-50; col. 5, ll. 30-46). Chen further discloses that using the magnetic coils to control the force applied dispenses with the need for complex pneumatics and permits non-uniform pressures to be applied to the substrate to compensate for non-uniform polishing rates (Chen, col. 3, ll. 1-4).

We find that Chen's and Kajiwara's inventions may have a single membrane forming a pressurized chamber. However, Chen's invention with the magnetic particles embedded in the membrane and the coils advantageously permits control of the force applied without the need for complex pneumatics and permits non-uniform pressures to be applied to the substrate to compensate for non-uniform polishing rates. Based on these findings, we agree with the Examiner that it would have been prima facie obvious to combine Chen's method of using magnetic particles and coils with Kajiwara's method of controlling the force applied to the substrate in order to achieve Chen's advantages noted above.

Accordingly, the prior art itself provides motivation for the combination. Moreover, Appellant has not rebutted the Examiner's motivation of providing better control to Kajiwara's chemical mechanical polishing device by using Chen's method using a magnetically controlled membrane. Appellant's motivation argument is without persuasive merit.

Similarly, Appellant's argument that there is no reasonable expectation of success is without persuasive merit because both Chen's and Kajiwara's device are structurally similar as noted above. Specifically, Chen and Kajiwara may have a single membrane forming a pressurized chamber. Accordingly, based on the structural similarity, one of ordinary skill would have had a reasonable expectation that combining Chen's magnetic particles with Kajiwara's single membrane in the Figure 24 embodiment and Chen's coils with Kajiwara's polishing head 300 would have successfully produced a chemical mechanical polishing apparatus for practicing the claimed method. In fact, Chen's disclosure that using the coils and magnetic particle embedded membrane successfully allows control

of the force applied to the substrate supports our determination that there is a reasonable expectation that Chen's magnetic control system would be successfully combined with Kajiwara's chemical mechanical polishing head to provide such magnetic control.

For the above reasons, we sustain the Examiner's § 103 rejection of claims 3-5 over Kajiwara in view of Chen.

35 U.S.C. § 103 OVER SOMMER OR CHEN IN VIEW OF WILLIAMS

Appellant argues that Sommer, Chen, or Williams do not teach or suggest "selectively applying [pressure] at locations beneath areas of . . . at least one second semiconductor device structure that correspond to . . . raised areas of [a] first semiconductor device structure . . ." as recited in claim 16 (Br. 12). Appellant contends that since none of the references disclose controlling the polishing of a second semiconductor device based on the polishing results from a first semiconductor device, the Examiner's combination of references is based on hindsight and there is no reasonable expectation of success in making the combination (Br. 12-13).

We have considered Appellant's arguments and are unpersuaded for the reasons below.

Williams discloses a method of controlling material removal rates during polishing and for controlling thickness removal during chemical mechanical polishing using detection, statistical estimation, and time series analysis (Williams, col. 1, ll. 15-20). Williams discloses that chemical mechanical polishing issues of semiconductor wafers include global planarity which are dominated by macro effects, such as polishing pad velocity or wafer head chucking device (Williams, col. 2, ll. 34-37).

Williams discloses that uniformity from wafer center to wafer edge is the usual metric for chemical mechanical polishing processes (Williams, col. 2, ll. 37-38). Williams discloses that chemical mechanical polishing tools must provide thickness measurements that can accommodate custom spaced measurements of chosen length and point density in diameter or radius scan format (i.e., thickness measurements are taken on different areas of the wafer) (Williams, col. 2, ll. 40-43). Williams teaches an iterative method for adjusting the polishing time (Williams, col. 4, ll. 48-61). Williams' method polishes a first substrate to determine the actual thickness removal rate and then adjusts the polishing time for the second substrate based on the parameters determined from polishing the first substrate (Williams, col. 4, ll. 48-61). The process continues for the remaining "n" substrates (Williams, col. 4, ll. 62-67; col. 5, ll. 1-12).

Chen discloses a method for controlling the force applied to substrates during chemical mechanical polishing to control the uniformity of the polishing (i.e., increasing the force to address a center fast effect and a center slow effect) (Chen, col. 2, ll. 47-52; col. 3, ll. 1-6; col. 4, ll. 45-60; col. 5, ll. 5-13; col. 6, ll. 23-31).

Sommer discloses a method for linearly driving a substrate carrier to polish a substrate surface (Sommer, col. 1, ll. 12-13). Sommer discloses that a problem with the prior art polishing methods and machines is that they fail to produce a constant velocity distribution and thereby fail to achieve uniform material removal over the entire surface which is essential for a planar result (Sommer, col. 2, ll. 3-9). Sommer discloses that the linear drive mechanism permits any desired polishing pattern on the substrate to be achieved (Sommer, col. 13, ll. 32-37). Sommer further discloses that

magnets in the carrier may be adjusted to accurately control the amount of force, and thus the polishing rate, the carrier applies to the substrate being polished (Sommer, col. 13, ll. 24-49).

From the above disclosures, we find, like the Examiner did, that Williams discloses an iterative process in which the polishing characteristics of a second substrate are determined based on the results from polishing a first substrate. Accordingly, contrary to Appellant's argument, Williams discloses the argued claim feature.

Appellant's motivation and reasonable expectation of success arguments are without persuasive merit. Chen's, Sommer's, and Williams' above disclosures indicate that they are all concerned with controlling the amount of force applied to the substrate being polished to achieve a more uniform polished surface. Accordingly, in light of the prior art disclosures, we conclude that Chen's, Sommer's and Williams' disclosures would have suggested combining Williams' iterative process for determining polishing rates with Chen's or Sommer's process of polishing to control the amount of force applied to a substrate during polishing in order produce a more uniformly polished substrate. We determine that the teachings of the references suggest the combination. Thus, the rejection is not based on impermissible hindsight reasoning.

Furthermore, Appellant's reasonable expectation of success argument is premised on none of the applied prior art teaching the argued claim distinction (Br. 13). However, as noted above, we find that Williams teaches an iterative process where pre-polish and post-polish thickness measurements of a first polished substrate are determined and used to adjust polishing times for the subsequently processed substrate. Chen, Sommer

and Williams are all directed to polishing methods for achieving a more uniform substrate profile. Accordingly, we determine that one of ordinary skill in the art would have had a reasonable expectation that using Williams' iterative process in Chen's or Sommer's method of polishing would successfully produce a more uniformly polished substrate.

For the above reasons, we sustain the Examiner's § 103 rejection of claims 16-31 over Chen or Sommer in view of Williams.

DECISION

The Examiner's decision is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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